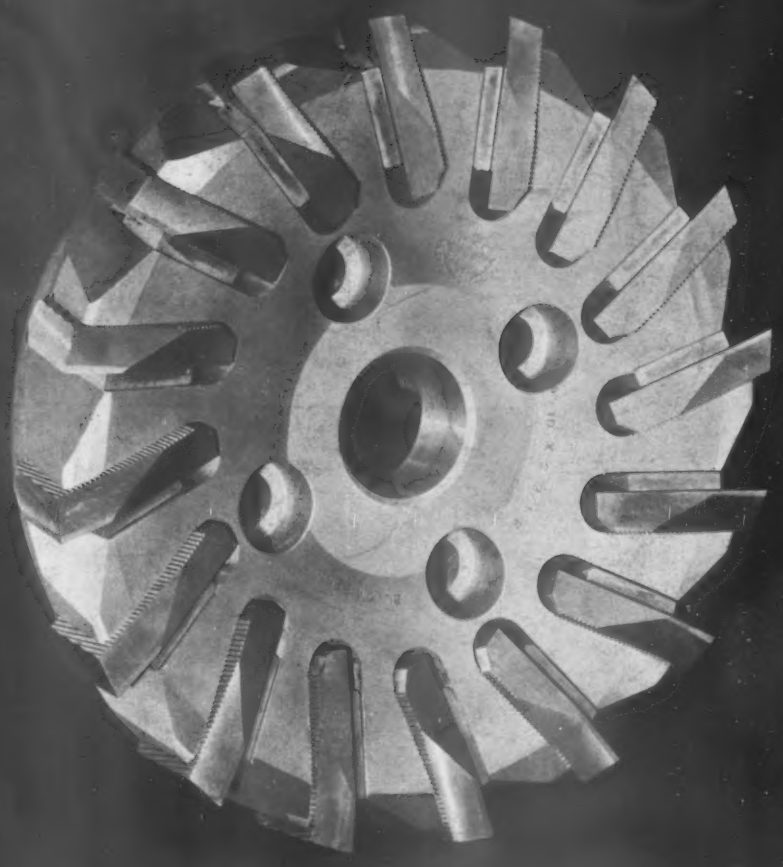
The Tool Engineer



Vol. IV No. 11.

MARCH

1950

IN THIS ISSUE

Shop Practices in the ORIENT

Tool-up of the Lincoln Zephyr

News of Mass Production from Everywhere

Official Publication of the
AMERICAN SOCIETY OF TOOL ENGINEERS

3600 PARTS PER HOUR *Checked* TO HALF A TENTH!

High precision inspection has demonstrated its economy conclusively. But now you can cut the cost of the inspection itself, and realize even greater savings.

The Sheffield Visual Gage (amplification 1,000 up to 10,000 or higher) is the real high speed inspection tool. Records on file show as many as 3,600 parts per hour checked to half a "tenth" or closer where desired.

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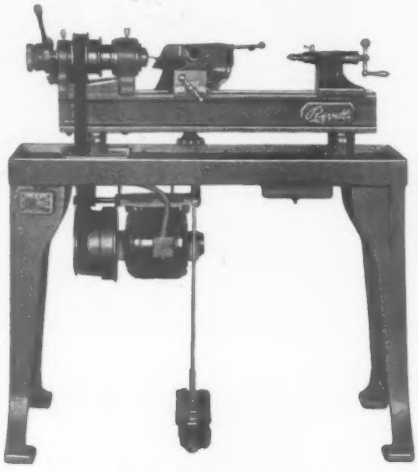
Dayton, Ohio

U.S.A.

RIVETT PRECISION BENCH LATHES

have been developed to meet every possible requirement from the laboratory to the highly specialized production shop. The illustrated assemblies on this page show three types of mountings: Cabinet, Bench and Oil Pan, and three types of drives: Speed Box Motor Drive, Direct Motor Drive and Horizontal Safety Drive.

A combination of one of these lathes, mountings and drives should prove the correct answer to your bench lathe requirements. Let us recommend the right unit for your purpose.



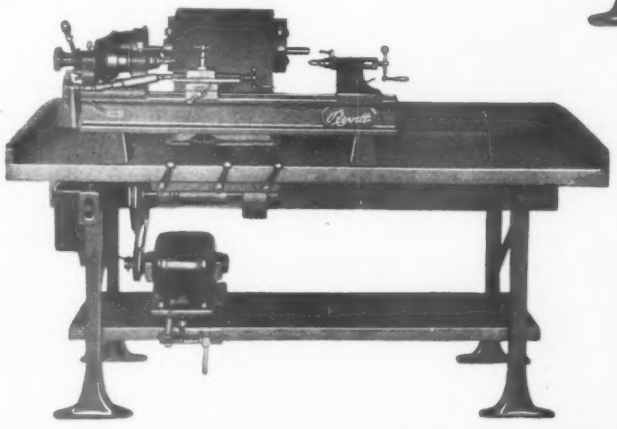
RIVETT No. 505BB

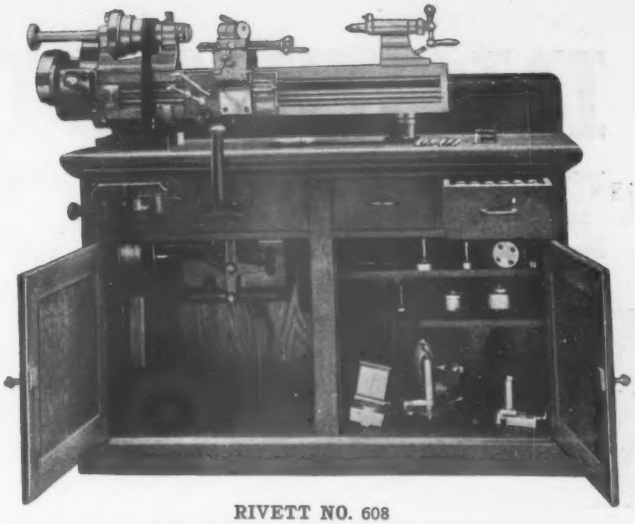
Precision Ball Bearing Bench Lathe

Designed for high production on small bar or chuck work. With Speed Box or Direct Motor Drive the spindle speed is maximum 4600 r.p.m. High spindle speeds on pre-loaded ball bearings, and tungsten carbide or diamond cutting tools produce perfect finish and as many as 300 pieces per hour. The Automatic Slide Rest is an unequalled production attachment for turning small duplicate parts. Bulletin 505-BB.

SPECIFICATIONS

Swing over bed, 8" . . . Collet capacity, ⅞" . . . Length of bed, 38".





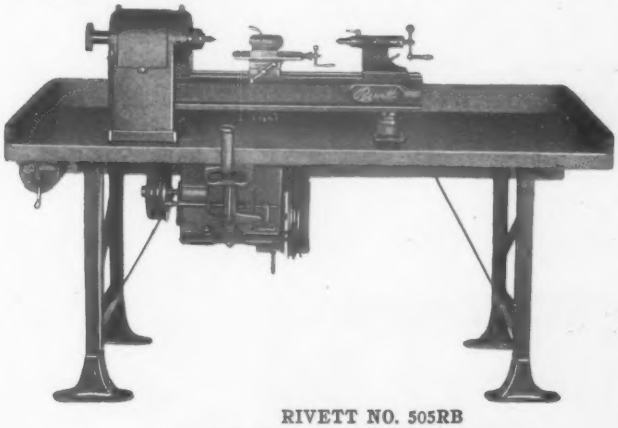
RIVETT NO. 608

Precision Back Geared Screw Cutting Lathe

Known throughout the world as "The Master Workman's Master Tool" in laboratories and development departments where the highest possible precision standards are required. Its finely made attachments enable a skillful user to finish practically any operation without recourse to other machines. Offered with quick change gear box or change gears. Bulletin 608-B.

SPECIFICATIONS

Swing over bed, 8½" . . . Collet capacities, ⅝" and 1" . . . Length of bed, 40".



RIVETT NO. 505RB

Precision Roller Bearing Bench Lathe

Enclosed Head Type

Furnished with open or enclosed type headstock and equipped with Timken "Zero Quality" precision roller bearings this model is unsurpassed for normal or super bench lathe use. With Speed Box Motor Drive 6, 12 or 18 selective spindle speeds from 100 to 2300 r.p.m. are available. The roller bearings are rated for 1775 lbs. radial and 1180 lbs. end thrust at continuous 2000 r.p.m. service. Bulletin 505-RB.

SPECIFICATIONS

Swings over bed, 8" and 9" . . . Collet capacities, ¾" and 1" . . . Length of bed, 38".

RIVETT NO. 505PB

Precision Plain Bearing Bench Lathe

Where high spindle speeds are not required. Rivett plain bearing two-taper, self-centering spindles assure long life accuracy. All series of Rivett lathes are equipped with complete lines of attachments for every bench lathe operation. The Horizontal Safety Drive provides 6 or 12 selective spindle speeds and high and low speed reverse. Bulletin 505-PB.

SPECIFICATIONS

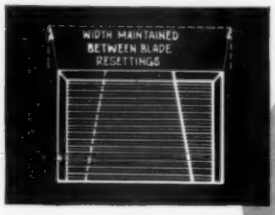
Swing over bed, 8" . . . Collet capacities, ½", ⅝", ⅞", 1" and 1⅛" . . . Length of bed, 38".

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS.

PIONEERS IN BENCH LATHE DEVELOPMENT

INGERSOLL ZEE LOCK



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LOW INITIAL COST

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REPLACEMENT COST

New set of blades at a fraction of the cost of new solid cutters.

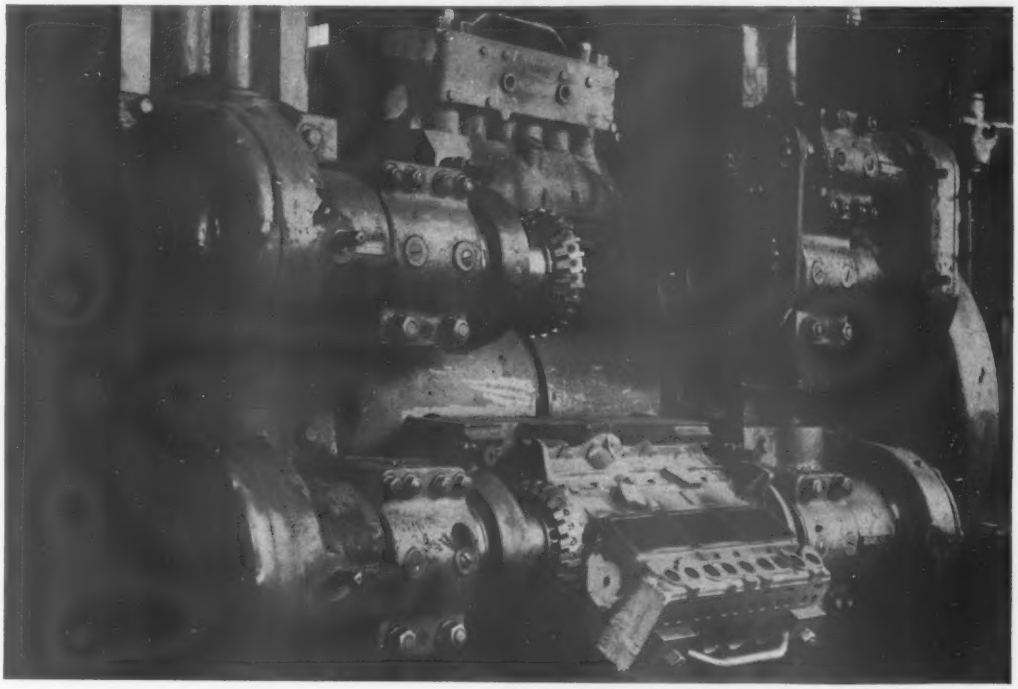
Furnished with Ingersoll Zee Lock Cutter Blades of High Speed Steel, Super-Cobalt high Speed Steel, Stellite or Tipped with Cemented Carbide.

Have Ingersoll engineer your cutting tools, special or standard. Write for tool charts and catalog.

THE INGERSOLL MILLING MACHINE COMPANY

ROCKFORD, ILLINOIS, U. S. A.

INCREASE PRODUCTION WITH HAYNES STELLITE J-METAL



Rough- and finish-milling the ends of cylinder blocks with five Haynes Stellite J-Metal inserted blade milling cutters.

● Haynes Stellite J-Metal cutting tools permit increased speeds and greater feeds. With these tools, more metal is removed per hour. Floor to floor time is decreased. The result is increased production.

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Haynes Stellite Engineers will be glad to show you how J-Metal will increase your production and lower your tool costs. Their assistance is part of Haynes Stellite Engineering Service and is available without obligation on your part. Write to the nearest District Office for details.

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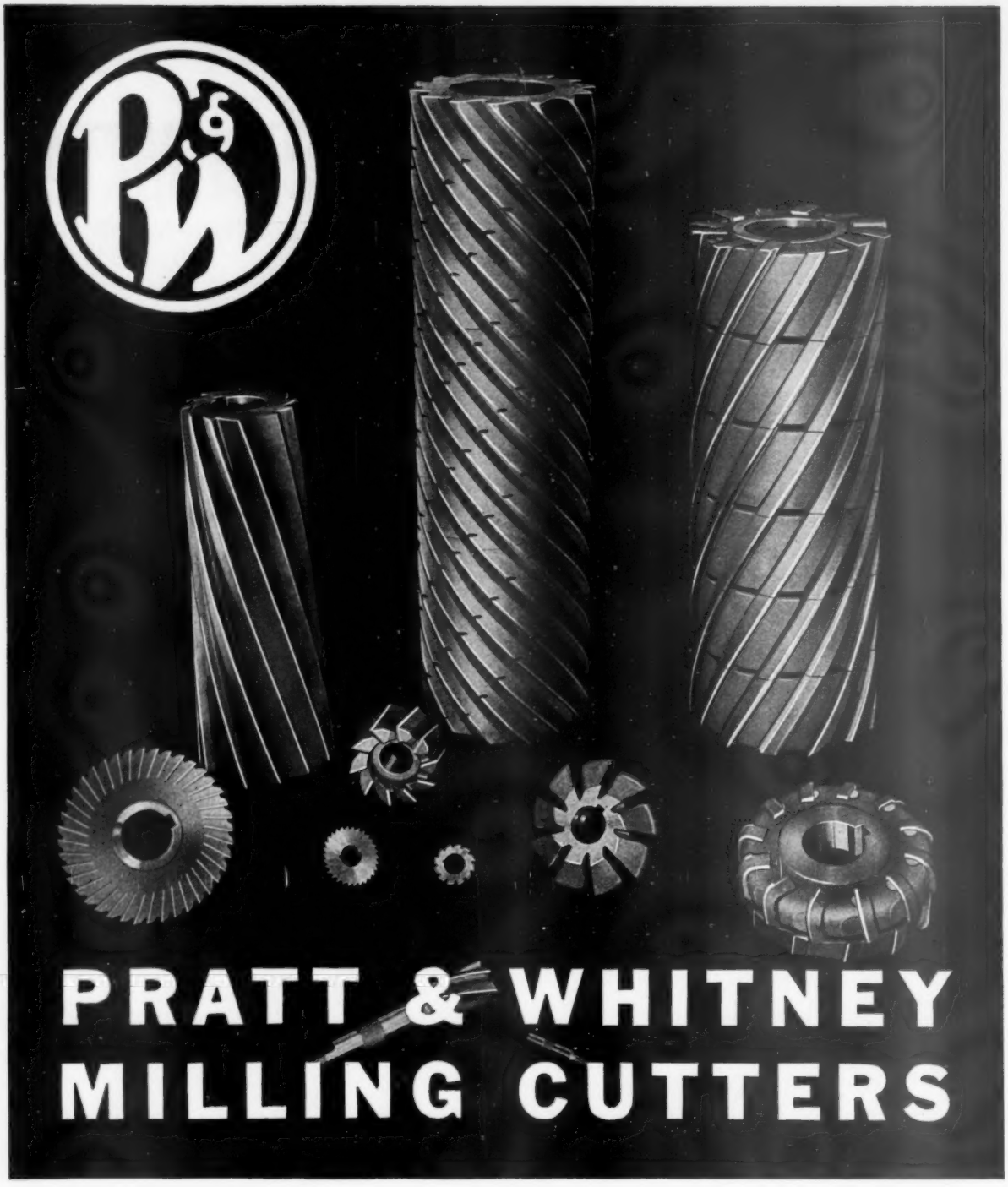
Haynes Stellite Welding Rods and information on other Haynes Stellite Products also are available through the 42 apparatus shipping points of The Linde Air Products Company



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Hartford, Connecticut

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Official Publication of the AMERICAN SOCIETY OF TOOL ENGINEERS

Vol. IV. MARCH, 1936 No. 11

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Owing to the nature of the American Society of Tool Engineers organization, it cannot, nor can the publishers be responsible for statements appearing in this publication either as papers presented at its meetings or the discussion of such papers printed herein.

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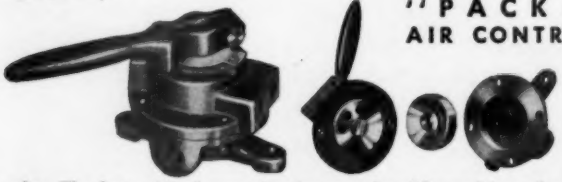
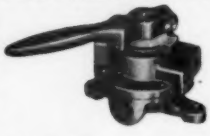


"PACK-LESS" AIR CONTROL VALVES

Four parts and a handle—and no packings whatever—make up the Hannifin "Pack-Less" disc type air control valve. The face of the bronze disc is ground and lapped to make a perfect seal with the seat. The simplicity and perfection of this design means reliable, accurate control. Maintenance is limited to re-lapping of the seat and disc after long service.

● STANDARD HAND CONTROL VALVES

Four-way type for control of double acting cylinders, for air pressures to 150 lbs./sq. in. or hydraulic pressures to 250 lbs./sq. in. Four standard types, 45 or 90 deg. movement. May also be used for three-way control of single acting cylinder.

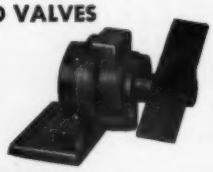


Faster PRODUCTION **HANNIFIN** MADE EASY

Hannifin Engineers, with over 26 years of specialized experience, offer authoritative advice on controls and standard and special pneumatic or hydraulic production tool equipment. Send for special valve bulletin No. 34.

● PEDAL OPERATED VALVES

With 45 deg. movement, no shut-off position. With 90 deg. movement, both outlet and exhaust closed in neutral. May be used as a throttling valve.



● SPRING RETURN VALVES

With 45 deg. movement, no shut-off position, and spring return for instant reversal of cylinder upon release of pedal.

● ROTARY TYPE VALVE

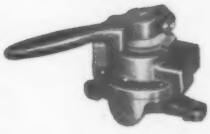
Heavy duty foot operated type. One pressure operates the cylinder, second pressure reverses the cylinder.

● MANIFOLD TYPES

Concentrates control of several cylinders and simplifies piping. Four standard types, 45 or 90 deg. movement and spring return types, for various standard cycles of control.

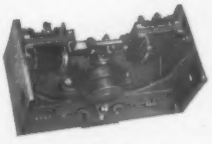
● DUPLEX TYPES

For control of two double acting cylinders, which may be operated in either direction and in any sequence desired.



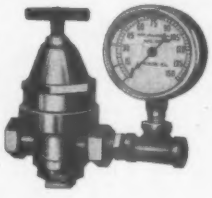
● ELECTRIC TYPES

Hannifin single and double types for remote control, for time-cycle operation, for four-way control, and a wide range of standard and special applications.



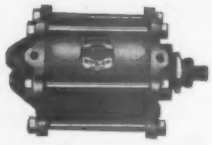
● PRESSURE REGULATING VALVE

A spring loaded piston type regulating valve of high-grade bronze construction, correctly designed for accurate, sensitive automatic control. Instantly adjustable to provide the most economical working pressure for any operation.



● AIR CYLINDERS

Stationary single acting and double acting types. Improved "Leak-Proof" construction with piston seal adjustable from outside the cylinder. A style and size for every need.



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FEBRUARY CHAPTER MEETINGS

CLEVELAND

THURSDAY, MARCH 12, 1936

Dinner: 6:30 P. M.

Technical Session: 8:00 P. M.

at

HOTEL ALLERTON — BALLROOM

Speaker: ALEXANDER H. d'ARCAMBAL, Consulting Metallurgist, Pratt & Whitney Company, Hartford, Connecticut

Subject: A Practical Talk on the Machinability of Metals

Mr. d'Arcambal is known to many members of the American Society of Tool Engineers, as an authority on the subjects of gages, cutting tools, as well as tool steels. Graduating from the University of Michigan with the degree of B. of Ch. E. in 1912, his wide experience has taken him through mass manufacturing plants of copper and brass, automobiles, aircraft and tools. On the latter subject Mr. d'Arcambal is particularly well qualified and will have with him at this meeting a most interesting array of exhibits to illustrate various phases of his talk.

All Production Executives Are Cordially Invited to Attend. Dinner tickets are $1.25 each. Make reservations through A.S.T.E. Secretary's Office—626 Penton Bldg., Cleveland, Ohio.

DETROIT

THURSDAY, MARCH 12, 1936

HOTEL FORT SHELBY—SPANISH GRILL

OPEN FORUM MEETING *(Not* a dinner meeting)

Technical Session 8:00 P. M.

In response to numerous requests, the Detroit Chapter has arranged for an open forum type of meeting in which all are invited to participate. There will be qualified commentators on the following subjects:

1. Why are there so few college graduates in Tool Engineering?
2. The place in the picture that Tool Engineers occupy in the eyes of management.
3. How can young men get started in Tool Engineering, when employers are demanding experience?
4. Why is there so little recognition given to manufacturing executives and Tool Engineers?
5. Attitude of various managements toward new tooling and machine programs.
6. What becomes of tools after production is finished?
7. Use and application of straight pipe taps in place of taper pipe taps.
8. The purpose of A. S. T. E.

You are urgently requested to make comments and ask questions not only on the above listed subjects, but on any problems confronting you in your tooling work.

PRODUCTION PERSPECTIVES

. . . .

Production, generally has continued at a level about the same as last month, although it is, we might say "spotty". For instance, **New England plants,** generally are busy—some of them working more than one shift, while around Detroit and in the automotive industry, the **"slight lull"** referred to in this column, has been even a little **more pronounced** the **past thirty days.** Some of this is attributed to new car sales falling off as a result of the severe weather. However, the opinion is universal that **"in about a month things are going to pop"** in Detroit. Every confidence is expressed that automotive production will be "way up" again—commencing in about a month. Many **machine tool builders** around the country have been and many are as yet **swamped** with orders for equipment for automotive production. C. L. McCuen, **Oldsmobile** president, recently announced a **substantial plant expansion at Lansing.** The new building will add 153,000 square feet and will house the Olds engineering department, increasing facilities by about 60%.

Cummins Engine Company of **Columbus, Indiana** has let a contract for construction of a new laboratory to be used exclusively for Diesel Engine research. The company has also purchased a tract of land near its present Diesel engine manufacturing plant to provide for further expansion. **John W. White,** formerly of Detroit, has **joined the South Bend** staff of **Bendix** for work on hydraulic steering brakes, controls and similar devices. Mr. White is a specialist on these developments. **Baxter Steel Equipment** Company has **acquired a factory** at Pike and Hovey in Indianapolis, in which will be produced steel furniture, display racks, store equipment, custom built counter and cabinet products, steel shelving lockers, **vending machines** and various types of equipment for public offices. Employment will be provided for about forty men, with more to be added this spring. **George J. Hoffman** is **plant superintendent.**

Thompson Products Inc. of Cleveland has **taken over a five story building adjoining the present property** and will annex it immediately to the operating plant. Railroad switch facilities were acquired with the building.

The **McKinney Tool & Mfg. Co.** of Cleveland will erect a **one story addition to their plant** at 1688 Arabelle Rd.

The **White Motor Co.** of Cleveland **will streamline the entire line of White trucks** including heavy duty models beginning in March. Success of their first all-streamlined series last fall resulted in the extension to other units.

Mass production plants which have already contracted exhibit space at the Great Lakes Exposition, June 27 - Oct. 4, are the P. A. Geier Co., White Sewing Machine Co., Perfection Stove Co., Apex Electric Co., Cleveland Co-operative Stove Co., all of Cleveland, and the Foster Mfg. Co., Elyria, O., and the Hoover Co., North Canton, O.

From Unionville, Connecticut, we hear that the **Union Metal Work Corp.,** newly-organized has **started operations** in the former plant of Kamco, Inc., which it purchased at a federal court bankruptcy sale. The new corporation **will continue the manufacture of electrical appliances** and metal stampings. **Die Casting Co. of Derby, Inc.** has been organized in Derby, Conn., by Max Hirsch, president, and Charles Manger, secretary and treasurer. **James E. Lawler, 85,** shop foreman for **E. Horton & Son Co.,** Windsor Locks, Conn., chuck manufacturers, for many years until his retirement, died February 18. Both the **Union Mfg. Co.** and **American Hardware Corp.,** New Britain, Conn., showed operating profits during 1935 for the first time in several years. President Carl S. Neuman of the Union company commented that "the latter half of the year showed a considerable improvement in the machine tool industry, which is the principal market for our chucks." American Hardware showed in its surplus account a net gain (after adjustments) of $101,130.04, contrasting with heavy losses in 1933 and 1934. Employees of the **New Departure Mfg. Co.** division of **General Motors,** Bristol, Conn., numbering about 775 received approximately $275,000 as their return from the corporation's investment fund, according to Personnel Director J. Frederick Cox. **Casco Products Co.,** Bridgeport, automobile accessories, is building a large addition to the third floor of its plant, which will be 175 x 25 feet and will cost about $10,000. Several million dollars worth of machine tools were bought by Soviet Russia from **The Bullard Co.,** Bridgeport, during 1935, Amtorg Trading Co. revealed recently. Purchases of industrial equipment made in this country totaled $27,159.-000. **Russell Mfg. Co.,** Middletown Conn., is now operating some departments on three shifts, employing about 1,000 men as against 650 six months ago, due largely to increased orders for automotive products. **E. Ingraham Co.,** Bristol, Conn., manufacturer of wood-cased clocks, has awarded contracts for a three-story factory addition, varying in width from 40 to 80 feet, and 160 feet long, to be used for light manufacturing, storage and shipping. New electrical equipment, including a 1,500 kilowatt turbine, has been installed at the power plant of **R. Wallace & Sons Mfg. Co.,** Wallingford, Conn., silverware, necessitated by increased loads which taxed existing turbines.

Small tool industries in Springfield, Massachusetts and surrounding area have made a good start this year. **Tap and die business is reported as good** and **large metal manufacturers are placing a good volume of work with smaller concerns in the tool and die field.** The **Atlas Tool Company** which has recently started in Westfield taking over the Central Machine Shop, **finds it difficult to take care of its orders owing to a shortage of tool makers.** Robert D. Towle and Frank D. Aldrich are proprietors of this concern.

The United States **Armory's shops are not quite so busy** for the time being, and quite a number of draftsmen have been released there; but most of these have been taken on at other establishments. The **present year is expected to be an active one at the Armory,** however, **with the new semi-automatic rifles being made** and with its shops producing more of a great variety of items used by various government departments.

Manufacturers of nuts in Westfield have experienced a revival owing to the activity of automotive and machinery industries. The New England Milled Nut Company is **employing a night shift** and the Westfield Metal Products Company is **working overtime to meet demands** of manufacturers and jobbers.

More than **60 men have been added** to the list of employees in the shops of the **Greenfield Tap and Die** Corporation, Greenfield, Massachusetts in the past six months, officials of the company reveal **as an indication of improvement in the machine tool business. Abrasive** industries in the Westfield, Massachusetts area **show decided gains** in operations, **American Abrasive** Company of Westfield reports a much better year in 1935 than in 1934, and January volume was on a par with a year ago. **Cortland Grinding Wheels** Corporation of Chester is **reported as producing in double the volume of a year ago. Vitrified Wheel Company** of Westfield is **running better than a year ago** and is on a level corresponding to that of 1925.

John Slater, foreman of the small tools division of the **Brown & Sharpe Manufacturing Co.,** Providence, died at his home in Providence following several months of failing health. Mr. Slater has been an employee of the firm for more than 40 years.

This Thing Called RESEARCH

By **FERDINAND JEHLE,**
White Motor Company

As given before Cleveland meeting, January 9, 1936.

The dictionary gives as the definition of research — Diligent inquiry, examination or study; laborious or continued search after facts or principles: investigation, as microscopical research; historical researches.

We are therefore engaging in research if we look for facts. The exact nature of the facts we are searching for is of minimum importance or of no importance at all. It may be that we are conducting researches in literature, in astronomy, in music, in the causes of the depression, in the design of machinery, in medicine, in the performance of automobiles, in the preparation of food or fine wines, etc., etc.

It seemed to have been the general impression for a long time that research work consisted only of investigation of matters of no practical value whatsoever, and which held out no promise of ever becoming useful. In other words the field was confined to what the populace called *Pure Science*. This definition of Pure Science was created, undoubtedly, by the practical man. A friend of mine once defined the practical man as "A man so busy repeating the errors of his ancestors that he has no time to keep up with modern thought and progress." It is a definition well worth remembering.

For many years I have had posted at all important work points in my laboratory a quotation from one of Dr. Arthur Gordon Webster's lectures. It so clearly defines the method of doing research, or experimental work that I can not resist the temptation of giving it here. Dr. Webster says:

"The proper order of procedure may be stated: 'Think, calculate, plan, experiment, think—and first, last, and all the time—think.

"The method often pursued is: Wonder, guess, putter, guess again, theorize(and above all avoid calculation."

If all investigators kept the words of this quotation before them, better work would result.

Tools of the Research Man

What does the research worker work with—what are his tools? Are they complicated, intricate, and expensive? Sometimes all of that but not necessarily. They must fit the problem. Much of the world's important research work has been performed with very few instruments and some without any in the ordinary sense of the word. Great researches have been made in libraries with books as the only tools. Consider for the moment the modern astronomer with his equipment of fine telescopes, cameras, spectroscopes, and other elaborate equipment. With this equipment he looks into the great beyond and makes wonderful discoveries. Then turn back to January 7, 1609 when Galileo first saw Jupiter and some of her moons through his little home-made telescope! I hope that you will not understand this to mean that I would suggest that the modern astronomer's equipment be reduced to a simple Galilean telescope. No, indeed! But I do want to bring out that the instrumentation must fit the work in hand. To the modern astronomer Galileo's small telescope would be useless because everything possible to see with that instrument has already been seen centuries ago and consequently our knowledge could not be increased with it. On the other hand, had Galileo possessed one of our modern telescopes, he probably would have looked past Jupiter and her moons into space he could not fathom for lack of a foundation to rest upon.

No—a research worker must not of necessity be surrounded by wires, vacuum tubes, potentiometers and other —mysterious instruments. Just those necessary for the work in hand. But be careful that you do not err in the other direction and base elaborate calculations on measurements taken with equipment too crude for the problem under investigation.

Watt invented the steam engine indicator and constructed a crude model. With this crude piece of apparatus he conducted researches which enabled him to greatly improve the steam engine. Remember—the engine which Watt had to improve was crude. Today his indicator is in a museum. Leave it there and admire it but do not take it or its replica and use it for studying the combustion characteristics of a modern high speed internal combustion engine. For such an undertaking we must have better and possibly more intricate equipment.

In the discussion of research and research workers we must not forget those who have worked in the field of medicine and fields related there to. If any of you have not read Paul De Kruif's book "Microbe Hunters," please read it. It covers the whole history of the men working in the vast field of studying microbes from the old Dutchman, Leenwenhock, who discovered microbes 250 years ago through microscopes he made himself, to the work of our own Dr. Walter Reed in fighting yellow fever.

Now let us come down to our own material interests. What in our field, that of machinery, has been accomplished by research? Research and invention, to a large degree, at least, go hand in hand. Quite true some great inventions have been conceived by sheer luck—by stumping ones toes on them. Generally though all great inventions have been the results of industrious-tiresome research. It has been said that a housewife never invented anything which lessens her labors. At least most of the great labor saving household appliances were invented by men. It was necessary for them to first make a study to determine the necessity for such devices and then to work them out, i.e., design them. That is research.

Have you ever stopped to think what our great inventions have done for the general welfare of the world? Due to them slavery has disappeared from the human race. You say slavery was not wiped

out by mechanical invention? Not entirely—maybe. A great Civil War was necessary to wipe out slavery in this country. But *was* it necessary? My friend F. O. Richey, says not. The worst form of slavery was that of the galley slave. No war freed him, yet there is no galley slave today. Why not? With the perfection of the sailing ship, later the invention of the steam ship, the galley slave did not pay. It was quicker, better and cheaper to navigate by steam than it was to chain the galley slave to the oar, and so he was freed. Now is it not permissible, my friend asks, to reason that if in addition to the cotton gin a cotton picker had also been invented slavery in the South would have been discontinued because it did not pay and a great war would have been prevented.

Yes, the arm of research and invention reaches far and scatters benefits over all the territory it covers. Even though the products of research and invention cover fighting and war machinery that statement still stands. War is fundamentally not humane, but with modern equipment it has grown more humane.

But we have not yet touched on anything directly applying to the design and construction of tools and that is the subject in which you are interested primarily. Of course, you are workers in the field of research in the broad sense we have treated it here. Every time you have gone to the shop, made a study of a process and gone back to your desk or drawing board to devise means to improve it, you have done a piece of research. But you say what has the research worker in the fleld of pure science done for you—the physicist, the chemist? The results of the work of these scientists is in daily use by you. It has become so commonplace that you do not recognize it. As Tool Engineers you are interested probably primarily in the measurement of length. You talk of 1/1000 inch with as much ease as we referred to an inch a century ago. Yes, indeed, with Johannson's blocks you measure to 3/1000000 inch. The physicist made this possible. Our standard of length is, of course, the meter. The meter was supposed to have been 1/1000000 of the earth's quadrant. Our better instruments have found this to be wrong. So for years we said it was the length of a platinum bar kept in Paris. A duplicate is at the Bureau of Standards in Washington. Of course they are destructible. If they were destroyed could we reproduce them? Yes, but not by measuring the earth's quadrant. Dr. Michalson, a physicist, invented the interferometer and with it measured the meter in light waves. As long as there are light waves, therefore, the meter or any other measurement can be reproduced.

For years bearings and gears were inspected by ear for noise. What to one man seemed quiet, appeared noisy to another. So a physicist worked out a little device which on an electric meter tells you just how noisy a noise it. So we have a good yard stick for noise and it is in daily use.

As alloy steels and other materials became harder due to the efforts of some research worker in metallurgy, and it became more difficult to machine them, and you were just about to give up in despair when out of the laboratory of the GE came Carboloy and your troubles were solved. This was the result of a valuable piece of research.

In conclusion let me read an excerpt from "The Spirit of Shakespeare in Physical Research," a lecture delivered by Owen D. Young, Chairman of the Board of General Electric at the University of the State of New York:

" And so I salute the workers in physical research as the poets of today. It may be that they do not write in verse, but their communications are of such lively interest that they are on the front pages of our newspapers and command space in our cultural periodicals. They appeal to the imagination of us all. They contribute the warming glow of inspiration to industry, and when industry pulls its ideas down from the heavens to the earth and harnesses them for practical service, it too feels that it is an important factor, not only in the making of things, but on the larger stage of the human spirit. There may be enough poetry in the whir of our machines so that our machine age will become immortal."

The Tool Engineer

EDITORIAL

Have You Thought of it this Way ?

With the progress constantly being made in mass manufacturing methods resulting from science and invention, the question is often asked "What is to become of the future generation, with this continual lessening of the need for labor?"

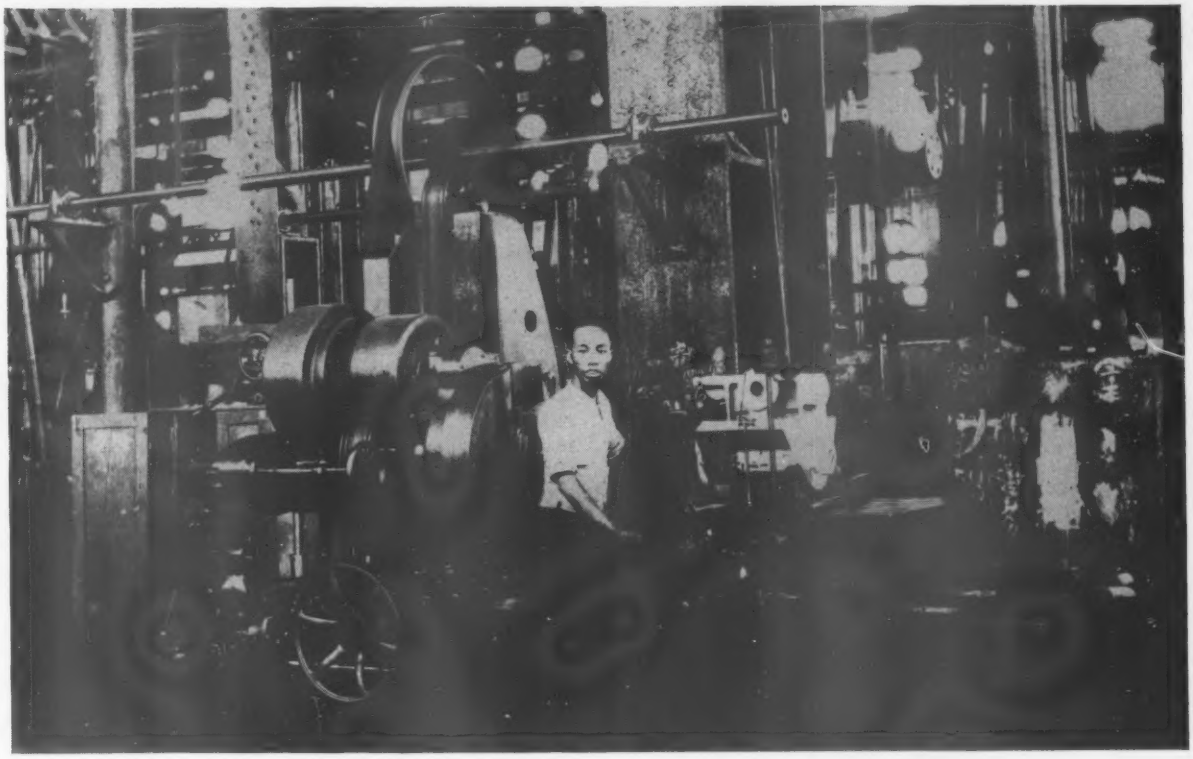
This is a natural question to ask in depression times, when there are—even yet—a great many unemployed. But, in reality, there is an abundance of labor needed now and there has been right along. The trouble is, that in our present economic system people, generally, are prone to waste or misdirect surpluses in bettetr times—necessitating a re-adjustment or depression, so as to level out production to economic demands. If all the needs of America—consrtuction, repairs, improvements, new equipment—could be bought and paid for *now* there would be very little if any unemployment—especially, if work was spread out through the whole year rather than a few months of "peak production." And, this reminds us of the marked shortage of tool makers reported from different sections of the country. We are inclined to think that the condition already referred to is largely responsible for this shortage. When times are good few are willing to enter apprenticeships, and it is a surprising fact, to notice now, how many there are who would not know how to do ordinary work in the tool room, shop or plant.

There are many people who are now willing to admit that debt (installment buying), taxes, interest had had more to do with these conditions than any over production by farmers or machines.

A piece of hardened tool steel in the shape of a horseshoe can be magnetized to lift approximately 10 pounds per square inch.

The hardest tumble a man can take is to fall over his own bluff.

Shop Practices in the ORIENT



Machine Shop in Hong Kong, British Crown colony, which has become, virtually, a training ground for Oriental machanics. Skilled lathe hands receive $1.20 per day.

By **WALTER BUCHLER**
World Traveler and Correspondent
As Told to Roy T. Bramson

PREVAILING shop practices in far away countries of the East offer an interesting contrast to the highly specialized Tool Engineering methods of this country. The term Tool Engineer is practically unheard of in the manufacturing centers of China, Australia, India, the Malay Peninsula and Egypt, although quality work and fairly close tolerances are maintained in metal processing shops of these countries.

Hong Kong, a British Crown Colony, is a most beautiful island. The diversity of machine shop work done in important shipyards there is representative of the more advanced shop practices in Asia. Managers of the different departments as a rule are British, while the foremen and men are Chinese. Hong Kong, located nearly 10,000 miles from the United States, depends for the most part for her materials in the way of steel and iron on this country and Europe.

The Chinese machinist usually acquires his experience through a five year apprenticeship. In the first year he does routine work, in the second he is given small jobs to do and in the third year he will assist a journeyman machinist. In the fourth year he will be assembling small parts and working on engines, while during his last year of apprenticeship he is expected to undertake any job in the shop. If an apprentice wishes to become a draftsman, he must further serve three years additional in the engine shop before he can go to work on the board.

Chinese machinists are very much slower in their work than the American machinist, but the Chinese worker is conscientious and capable of turning out a product which compares favorably with any made abroad. Chinese "Turners," (lathe hands) particularly, are very accurate in their work and it is interesting to see them at their machines with an improvised fan driven from the machine, which keeps them cool while working. They are great tea drinkers and all have their small pot of tea, and little fires may be seen all over the shop over which they brew it. They also erect "joss" houses (miniature places of worship) at the feet of columns in the shop, in order to "joss" the shop—in other words to bring good luck.

Hong Kong has become, more or less, a training ground for Oriental mechanics and after serving an apprenticeship there, many of them obtain jobs in other parts of the Orient particularly in the Malay states. The average pay in Hong Kong is $1.20 per day for a skilled lathe hand.

The Chinese machinist is apt to be more independent than other craftsmen and if there is a strike he is probably the first to file complaint. This class

of worker is paid by the day as it is difficult to get him to work for longer periods. Very few Chinese go in for mathematics and it is here that the American or European in charge has to make all calculations for gear cutting, and in fact, is required to set machines himself.

● In South Australia a foreman is employed in most shops, and in the larger establishments there is a foreman for each section. He is promoted to that job from the pick of the men according to capability. The average South Australian is capable and practical. The foreman is usually a man of practical experience who has risen from the ranks. His duties are of a general nature, supervising and laying out the work and seeing that it is properly carried out. The qualities required in a foreman are a thorough knowledge of the work and an ability to handle men. Most foremen of that country are ambitious and have hopes of establishing or securing a business of their own. A fair number of these men attain their goal and open up small shops, usually specializing in one or two branches of their trade. They call on business prospects themselves and the generally friendly feeling and absence of all class distinction among people in that State make it much easier for the small man to obtain business and establish himself in a business of his own. Prevailing high wages provide an opportunity for the small shop to compete with larger concerns.

Foremen in Adelaide, the capitol of South Australia, receive 30% more than the men. The average hours of work are from eight or eight-thirty in the morning and forty-four hours per week. Labor is easy to handle in South Australia, thanks to a friendly feeling prevailing in the shops. Men are treated well and foremen and executives, generally, are very broadminded and know their men individually, even maintaining direct contact with their families and interesting themselves in their outside life. The men in the office (corresponding to our Tool Engineers) are usually experienced men who have served their apprenticeship and many of them have received special training at the government school, which offers general technical training at the government school, which offers general technical training.* Foremen take pride in their work and are careful to see that machines are not overloaded and take a particular delight in placing their men at jobs in which the individual man has a natural aptitude.

Engineering in Malay

At present, it is generally recognized that expert Tool Engineering is essential in the sale of machinery in Malay. A policy of some of the larger companies in Malay is to have trained production men selected by machinery manufacturers. In this way it has been possible for one large engineering concern in Singapore to handle a great variety of lines. It is now possible for Chinese or Malayans to come to the supplier, state their needs, and go ahead assured that they will obtain the best advice as to the establishment, laying out and running of their plants. Formerly, however, the supplier's idea, apparently, was to load the buyer with whatever machinery and equipment he could be induced to purchase, irrespective of whether the raw materials were suitable or the customer had the experience or personnel to operate a plant.

European engineers in charge of Government, Municipal or Industrial undertakings are highly capable men. The Chinese, too, are showing an ever keener demand for more intelligent service. Preliminary negotiations in the sale of machinery or equipment are usually conducted through a Chinese compradore, who is in close touch with Chinese buyers. He advises his firm as to the suitability of customer's prospective needs, and is generally aware of any plant expansions or new work being planned. Once the compradore has referred a possible customer to his firm it is for the engineering experts to convince the customer of their ability to meet his requirements. The majority of potential buyers understand and read English.

Generally speaking, many of the manufacturing plants in Malay are equipped with modern machinery. These are owned and controlled by Europeans experienced in modern engineering practices, but the labor available renders working conditions more dijcult than in the Western country. In the machine shop it is necessary to give clear plans, thus, more time is spent in the drafting room than in the shop. Designers and draftsmen must show a *picture* rather than a drawing as the native worker understands a picture but not a drawing. This also applies to the buyer. As an instance, a Chinese customer instead of making a drawing and writing a letter, sent wooden models of a pipe vise, a surface gage and some drill sockets.

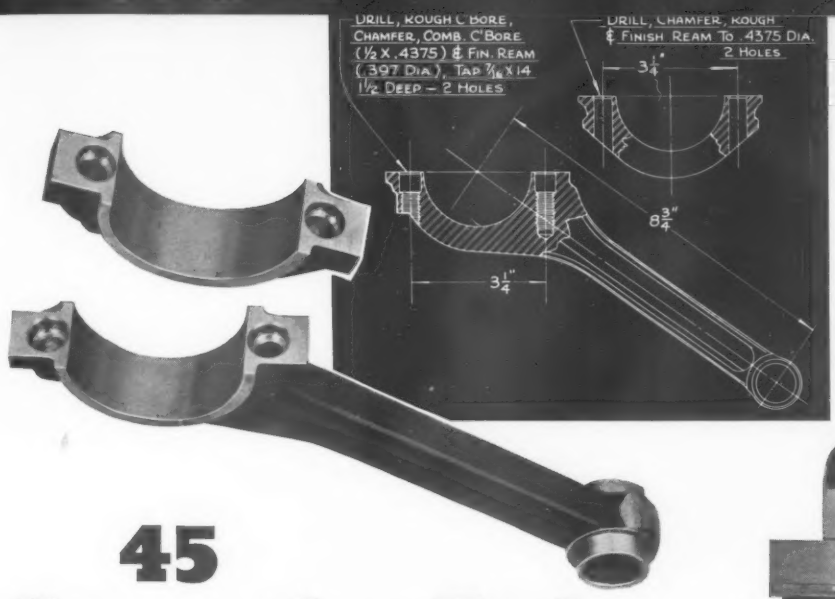
The average Chinese worker is inclined to be frightened by pneumatic tools, reckoning that there are devils inside them. Instead of employers hiring labor direct, they frequently engage Chinese contractors to do the work at contract rates; the firm supplying the power, materials, tools and machines and the contractors employing their own men in the company's shop—the idea being that the Chinese will work for an Oriental better than for an Occidental. This is actually a fact. A Chinaman does not mind working harder for a fellow countryman at longer hours and lower rates, without feeling that he is "losing face," whereas he would not dream of doing the same thing for a Westerner. In this system of contract work the practice is to show the Chinese contractor a drawing or specification and ask him to quote a price, the work being let to the lowest bidder.

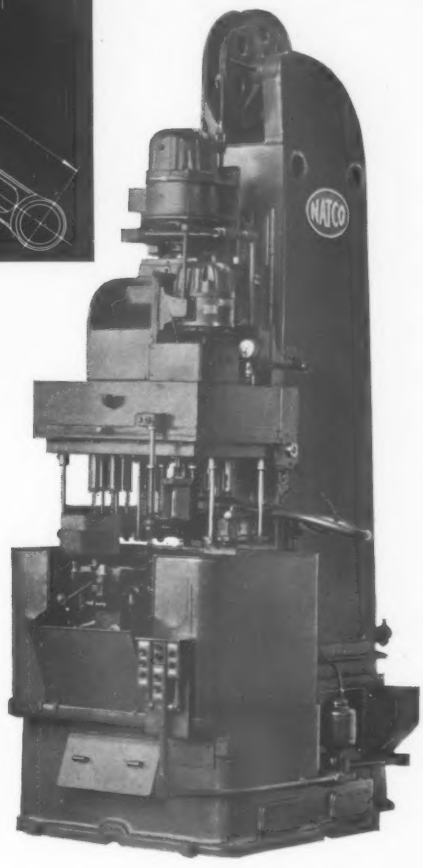
Lathes are in universal use in Malay. Chinese make good lathe hands, but are slow and incline to high finish rather than speed. Planers, shapers and slotters are to be found in the more up-to-date shops and all are well understood by the Oriental, and are efficiently handled. More supervision is required for gear cutting machines which have come into greater demand with the demand for accurate production. There are, however, only two concerns in Malay capable of producing cut gears because of the expense involved and the difficulty in training natives to do this work. One has actually to stand over a native doing work of this nature in order to get a perfect job.

Portable electric tools, such as drills and grinders are coming more and more into general use in Malay as it has been found more economical to take the tool to the job rather than the job to the tool. Electric motors are in almost universal use. Some

(*Continued on page 22.*)

*Editor's Note: Should our good friend Jack Finlay, A.S.T.Eer, Tool Engineer of the Small Arms Factory at Lithgow, N. S. Wales, Australia, chance to read this, we hope he will again write us more about his work in his important plant, as he did in the January issue of *The Tool Engineer*. (See page 14.)


DRILL, ROUGH C'BORE, CHAMFER, COMB. C'BORE (½ X .4375) & FIN. REAM (.397 DIA.), TAP ⅜ X 14 1½ DEEP – 2 HOLES
DRILL, CHAMFER, ROUGH & FINISH REAM TO .4375 DIA. 2 HOLES
3¼"
8¾"
3¼"



45 Connecting Rods and Caps per hour

● The NATCO vertical combination driller and tapper which is shown is performing several drilling, chamfering, counterboring, reaming and tapping operations (see sketch for operations) on the connecting rod which is also shown. The production rate is 45 to 50 per hour.

Previous methods would have required several machines—but this manufacturer took advantage of NATCO equipment and combined the operations—greatly reducing production costs. This is another example of NATCO engineering—another example of a NATCO designed and built to reduce costs on a specific connecting rod job.

This NATCO was Engineered For a Specific Connecting Rod Job

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NATCO
SOLVES YOUR HOLE PROBLEM

NATCO Drilling, Boring, and Tapping Equipment

Unusual Operations and Assembly Methods Characterize Lincoln-Zephyr Tooling Program

By **WALTER WAGNER**
Master Mechanic, Lincoln Motor Company
Member A.S.T.E.

THE introduction of the new Lincoln-Zephyr Car, which has now been in production about four months, has created widespread interest from all sections of the world. Production now necessitates two shifts in many departments, and in some departments three shifts are running.

The unconventional body, radiator and hood design require little that is unusual in die design except a rather heavy expense for a complete set of dies. But the lamps in the fenders meant some rather tricky die design because of the unusual heart-shaped front and the sweeping curve on the side elevator.

The body, hood, radiator grille and frame are welded together as a unit. This idea is somewhat new in the field. The strains and stresses ordinarily absorbed by the frame are transferred through the side pillars and around the top. This design allows a short width frame which means a low center of gravity and naturally a safer riding condition. The motor, being a 12-cylinder V-type, involved an entire new set-up of tools. The machining of all the motor parts was arranged on lines of machinery from a previous model. This meant some economy but modern machinery for milling, boring and grinding was purchased wherever it showed any advantage.

The crank and cam shafts are cast alloy. The hard durable wearing surface of this metal is indicated in its machining, as all speeds, feeds and cutting angles had to be carefully studied before any success was obtained, and many of the operations had to be grinding, instead of straight machining to hold to close limits on important sizes. The machining of the connecting rod is carried through the entire line by locating on four centers, which are accurately drilled in a first operation. This method has a very decided advantage as it prevents any "fighting" of any errors set up on the other operation. We start the rough boring and go to the last finish grinding on these centers. The piston is also made of cast alloy which meant another change from conventional practice of machining, as this type piston has a very thin wall and this means very little machining and plenty of grinding. A battery of centerless grinders is used, as only a few thousandths can possibly be removed per operation to prevent distortion of the thin wall.

The cylinder blocks are extra heavy castings to handle from operation to operation so therefore many overhead hoists and conveyors had to be employed. This cylinder block is machined in the usual manner with a first boring and semi-reaming and a tungsten-carbide high speed boring operation followed by a light honing. This tungsten-carbide boring operation has proved to us to be very accurate and produces an extremely smooth finish on the piston bore. Care must be exercised in mounting the machines on a solid foundation, and room temperature must be carefully controlled in order not to create any distortion of the precision spindles.

A rather difficult back facing operation is performed on the valve stem guide hole. A 12-spindle multiple spindle machine was made for this operation. All twelve spindles enter the 1" diameter hole and travel down to the correct depth. The entire head then shifts sideways 1/16", immediately circles similar to planetary motion, and reverses through this same path. Then, all spindles stop and the whole head shifts back to the center of the hole and backs out ready for the unload. Mention is made of this operation because it necessitates extreme accuracy, as the face has to be absolutely square with the hole. There are other methods of doing an operation such as this but I doubt if any is as fast or more accurate.

Several thousand feet of conveyor are used to move finished parts along the line of assembly to be set-up into units, and in some cases put back on the conveyor and moved to the final assembly. An unusually long conveyor is used from the rear end of the factory to the final assembly. The motors are then put up and sent to the finished body, which comes through an opening from the second floor trim line ready for the motor, axles, wheels, fenders and other miscellaneous parts. This one assembly line, surprisingly, assembles all these parts to a finished car at the rate of 125 in 8 hours in a length of less than 325 feet. An endless conveyor is used when the body-in-white is started through the clean-up and paint ovens, around through the trim shop and then through the opening to the first floor to receive the motor and other chassis parts.

Conveyors are used quite generally and they certainly have proved their value in saving costs of stock storage and increasing assembly efficiency. Probably the outstanding feature of the new Zephyr line-up is the well planned conveyor set-up, which only made possible the crowding of this entire Zephyr line-up without the addition of any new buildings.

The Zephyr is being produced on an increasing schedule from day to day and in these same hours a satisfactory production of Lincoln cars is also being made.

LOOKING FOR THE NEEDLE IN THE HAYSTACK . . . . .

is just about as hard a job as trying to cut die set costs without using DANLY DIE SETS

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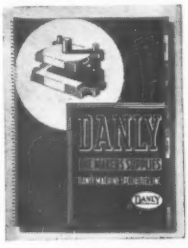

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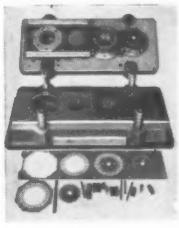

● Danly Die Sets are more accurate—give more accurate parts—and greater production per die before regrinding.

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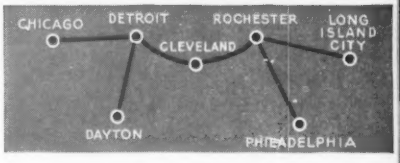

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DANLY DIE MAKERS' SUPPLIES

Many Uses Found for Rapid Action Toggle Clamp

By **FRANK McKENNA**
Member A.S.T.E.

Rapid action Toggle Clamps, first used on the production lines of automobile body plants, are now being used in increasingly larger quantities throughout the country.

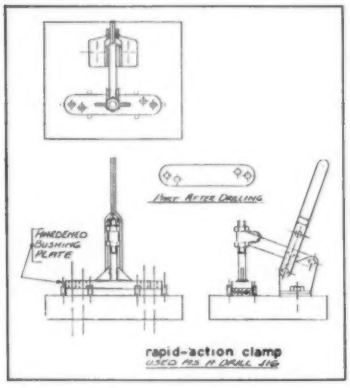


Figure A

The small job shop manager, confronted with the problem of a short run part with holes to be drilled may use a similar fixture to the one described in figure A. —Here we find the simplest of drill jigs, an okayed sample being case hardened and welded to the pressure bar. When the work is removed, chips may be removed easily. One clamp may be used on different fixtures, by the substitution of a new bolt for adjustment.

Figure B shows the device as applied to a hand hammer fixture, removable blocks being used for the metal to be formed around.

In the stamping plant we may find a use for a clamp as shown in illustration C. —The shell is being pierced on an arbor, and trouble was encountered with the part moving before the holes were pierced.

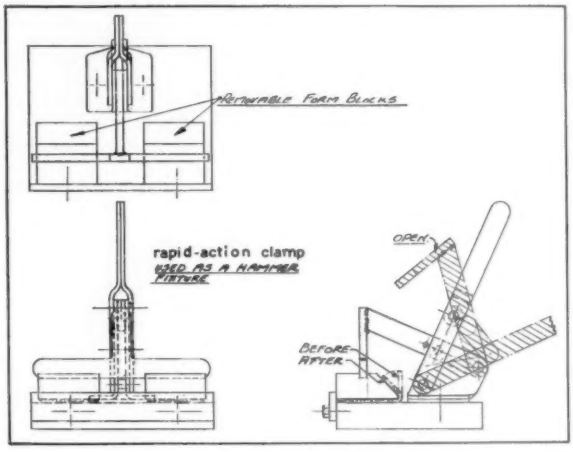


Figure C

Fixture builders requiring a clamp that will stand up against vibration will appreciate the possibilities of a new application of the Toggle movement, illustrated at "D."

The movement being totally inclosed in a pressed steel case adds to the strength and appearance, reducing the size by ⅓. The fulcrum is between the work and the pressure applied, permitting a final possible pressure of about 33 to one.

Figure B

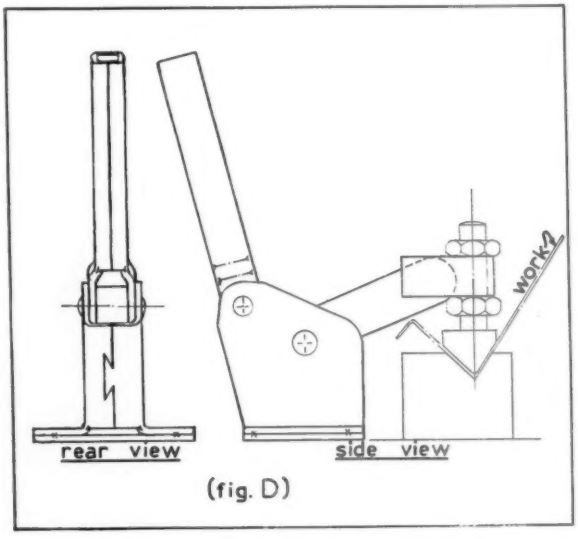


Figure D

ENGINEERED PRODUCTION
EXAMPLES FROM THE SUNDSTRAND FILES
No. 3604

Lathes
Milling Machines
Tool Grinders
Centering Machines
Balancing Tools

A NEW COMBINATION
Milling and Centering Machine
Cuts Costs, Saves Handling, Conserves Floor Space

A recent Sundstrand Engineered Production development is a Combination Milling and Centering Machine which mills to length and centers a wide variety of work ranging in length from 8″ to 38″ and in diameter from ¾″ to 3¼″. Machine, shown in Fig. 1, has 3-station trunnion-type fixture in which work is placed between self-centering jaws, against a positive stop at one end, in the first station; milled to length in the second station at rear of machine; and both ends centered in the third station. Machining completed, cutting tools return to starting position and stop automatically. Operator presses a button which withdraws large index pins from each end of the fixture. He then manually indexes fixture 120°, presses a button which returns the index pins; and starts the automatic cycle of rapid approach, feed, quick return, and stop. Sundstrand Hydraulic Equipment is used for operating the index pins and for rapid traversing and feeding the synchronized parallel transverse slides which carry the cutters for milling work to length. These slides actuate cams which feed the center drills into the work-pieces to desired depth. By this means the center drills may have variable feed, and a dwell at the completion of their cut, if desired.

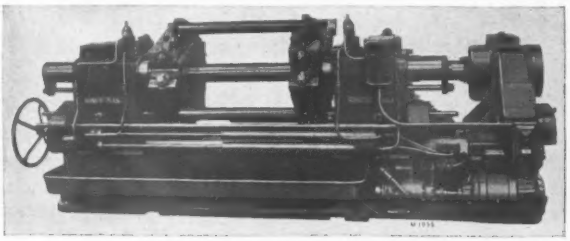


Fig. 1—Sundstrand Hydraulic Combination Milling and Centering Machine.

Fig. 2 shows the bars that are held in the fixtures on the machine shown in Fig. 1. In Fig. 3 is shown another type of work which is handled on this machine. Unit at left-hand end of machine can be adjusted readily for different lengths of work without altering relative position of milling cutters and center drills. Longer machines of this type are available. A fourth station can be provided for hollow milling operations on one or both ends of work-pieces, and automatic hydraulic indexing and clamping of fixture is available if desired.

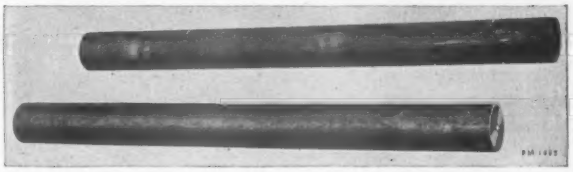


Fig. 2—Bars milled to length and centered on machine shown in Fig. 1.

This machine cuts costs, increases output, balances production, saves floor space, saves work-handling; and, in some instances, eliminates additional equipment formerly required. Its product is highly accurate throughout. Centers are clean, smooth, uniform in depth and relation to the milled surfaces. Accuracy of length is insured by micrometer adjustments for the two milling cutters. Ends are milled smooth and square with the axis of the work; this sometimes eliminates facing operations.

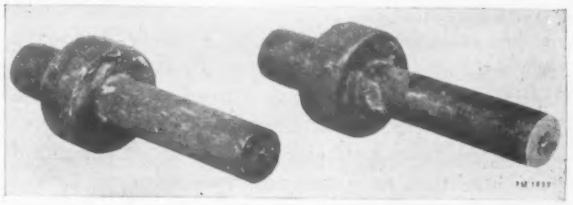


Fig. 3—One of many other types and sizes of work handled by same machine.

Investigate the possibilities for cutting costs, increasing production and saving floor space on your work with Sundstrand machines of this type. Reliable production and cost estimates submitted promptly upon receipt of your drawings and data.

SUNDSTRAND MACHINE TOOL CO.
2530 Eleventh Street, ROCKFORD, ILLINOIS, U. S. A.

A. S. T. E. Chapter News

CLEVELAND

The regular monthly meeting of Cleveland Chapter of the American Society of Tool Engineers was held February 13th, 1936 at the Cleveland Engineering Society headquarters in the Hanna Building at Cleveland. This was not a dinner meeting and the technical session was held at 8:00 p. m. Mr. E. W. P. Smith, Consulting Engineer of the Lincoln Electric Company was the speaker. His lecture was devoted to a practical discussion of welding Built-up Jigs, Fixtures and tools, with a brief history of welding and its origin.

A. H. d'Arcambal, an authority on cutting tools and metallurgy is scheduled to talk at the regular March meeting of Cleveland Chapter.

DETROIT

"Modern Automotive Lubrication and Maintenance" was the subject of the speaker, A. H. Frost, automotive engineer, who addressed the February meeting of A.S.T.E. in Detroit at the Fort Shelby Hotel. A most interesting part of the session was the discussion or question and answer period following the talk.

Ed. Beyma, Detroit A.S.T.E.er is the proud father of a ten pound son. Mr. Guy Swartz, who has long been confined to his bed with serious illness is recovering nicely and will soon be up and around again. Frank W. Curtis, manager of Firthite division of Firth-Sterling Steel Company has been a welcome visitor at the last two meetings of Detroit A.S.T.E. How about that Chapter you were starting in Pittsburgh, Mr. Curtis?

RACINE

Tool Engineers of Racine and other cities in this vicinity were addressed Monday evening, February 3rd, 1936, at Hotel Racine, by W. S. Drummond, President of the National Broach and Machine Company of Detroit, Michigan.

Speaking on the subject "Gears" Mr. Drummond drew attention to numerous developments in the last few years in the manufacture of good, accurate, long wearing, noiseless gears.

For various requirements he called attention to the matter of kinds of alloy steel and metal to be used, rigid and accurate machinery for the machining operations, proper hardening methods and correct lapping operations, are all necessary to produce an accurate, noiseless, long-life gear. He also called attention that regardless of how accurately a gear may be cut, heat treatment is almost certain to effect some variation in its dimensions and these variations when sufficiently large, must be corrected either by grinding or by lapping the hardened product.

He also called attention to the machinery on the market today for sound checking of gears before assembly and gear testers to record index errors, and to determine true helical angle, variations in helical angle, eccentricity and tooth parallelism. Part of his talk was illustrated with lantern slides, showing various kinds of gears, and machinery for testing them. Also a number of tools and machined gears were on display for inspection by the engineers present.

The meeting, was preceded by a dinner and was the largest meeting yet held, exactly 134 attending in spite of the inclement weather.

The J. I. Case T. M. Company of Racine, manufacturers of the well known line of tractors and farm implements have more men employed at the present time than at any time in the history of their business.

The Hamilton-Beach Manufacturing Company of Racine, manufacturers of electrical appliances are building a three story red brick addition to their plant. It will measure 80 feet by 150 when completed and will give them an additional 36000 square feet of floor space.

Practically every plant in Racine is busy at the present time and business conditions in general are good.

Detroit Chapter

A. S. T. E. "NIGHT OUT"

FRIDAY EVENING, MARCH 6th, 1936
9:00 p. m.

GERMANIA HALL
Mack Avenue cor Gratiot

For A.S.T.E. members and their gentlemen friends.

High Class Floor Show — Refreshments

Tickets $1.00

This is your opportunity to cash in BIG on your "night out". You couldn't find a better bunch or a better place. Let's all come and have lots of fun. This is Detroit A.S.T.E. Chapter's Annual Spring get-together.

For

HIGH PRODUCTION to CLOSE LIMITS Use the Barber-Colman Type A Hobbing Machine

BARBER B-C COLMAN

PRODUCTS: MILLING CUTTERS, HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, SPECIAL TOOLS

BARBER-COLMAN COMPANY
Rockford, Illinois, U. S. A.

Represented in the Detroit Territory by
HODGES MACHINERY CO.
544 New Center Building

Popular—Shipment of more than 100 Type A Hobbing Machines in the last 12 months, to meet the demand for higher production and closer limits on many different kinds of hobbing, demonstrates the popularity of these machines. Some of the installations are repeat orders. Others replace hobbing machines that have seen better days and which never could compete with our Type A Hobbing Machines on accuracy and production.

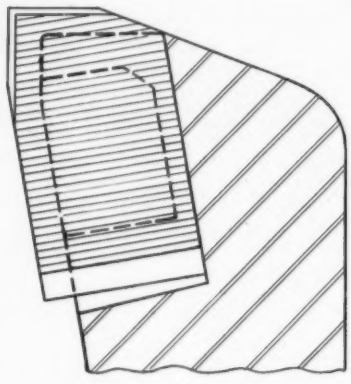
Productive—Our Type A Hobbing Machine is excellent for high production. It can be set up quickly and easily; has the power to pull heavy cuts smoothly, the strength to maintain alignment under heavy loads, the rigidity to resist vibration and chatter. For extra heavy work a heavy-duty hob-slide and drive are available on special order. Unusually high accuracy is maintained on all work within the Type A range.

Profitable—The high productive capacity and accuracy of Type A Hobbing Machines provide manufacturers who use the hobbing process, or who *can* use it, with a powerful aid in saving effort, increasing production, cutting costs.

Prompt Delivery—Type A Hobbing Machines can be furnished on reasonably short delivery. Write for details. For reliable production estimates, send drawings and data to us or let us send a Barber-Colman engineer to you.

THIS MONTH'S COVER

Built around the well known "Serrated Blade and Wedge Contruction," the inside cone type face mill as designed by the Goddard & Goddard Company of Detroit, Michigan, and illustrated on the cover provides grinding life where it is needed most in cutters of this type. It is a recognized fact that on a face milling cutter the actual cutting is done by the teeth on the periphery, the side cutting edges acting only as chip scavengers, and while the ratio of grinding of these two cutting edges varies with the job the major grind is always on the periphery. To meet this condition the inside cone type face mill was designed with the blade positioned as indicated in the accompanying drawing. It will be noted that the greatest length of the blade is approximately perpendicular to the axis of the tool and inclined slightly forward so that the greatest regrinding adjustment is provided for the cutting edge on the periphery, the ratio of adjustment between the two cutting edges being approximately six on the periphery to one on the side.



In cone type cutters as previously designed the greatest adjustment was on the side cutting edge where it was needed the least, the blade being so positioned that its longitudinal axis formed an angle of approximately 30° with the axis of the tool which provides an adjustment ratio of approximately one on the periphery to three on the side. This necessitated an actual waste of an unused portion of the blade in order to resharpen that portion of the blade which does the actual cutting. In comparison to this it can be stated that if during the life of the blade of an inside cone type cutter it has been adjusted outwardly one-half of its length, that portion which has been ground away has been actually utilized in resharpening the cutter and not simply removed to prevent excessive blade overhang caused by improper adjustment.

Radial adjustments are made in increments of the pitch of the serrations which is 1/16", the serration being located perpendicular to the bottom of the blade slot, and of course axial adjustments are proportional. By locating the serrations as mentioned above, two very important advantages are accomplished. First, blade movement is positively prevented while the tool is in operation as the serrations are perpendicular to the line of the major thrust, and with the wedge securely seated the tool is capable of absorbing loads far beyond those to which milling cutters are subjected, and secondly, uniform blade adjustments are easily accomplished as the blades can be set out one or more serrations as desired with the assurance that it will not be necessary to remove more stock from one blade than from another to make them all of uniform height, the serrations automatically establishing this uniformity.

Simplicity is the keynote of the serrated blade and wedge construction, there being only three component parts to the tool,—the body, the blade and the wedge. The body is made of an alloy steel heat treated for toughness and strength to last through the life of numerous sets of blades, and wedges are made from a carefully selected steel, just as carefully heat treated to make them suitable to their purpose. Blades, of course, can be made from the material best suited to provide the proper cutting medium for the job to be accomplished. Due to the simplicity of the construction, maintenance costs are held to a minimum as adjustments or blade replacements can be quickly accomplished by driving out the wedge, there being ample provision for the use of a heavy drift for this purpose to insure quick removal without damage to the wedge. After the blades have been placed in this new location, the wedge is reseated insuring ample blade anchorage. (Advertisement)

SHOP PRACTISES

(Continued from page 14.)

trouble with these is encountered in Malay because of extreme humidity and the temperature. Motor manufacturers are meeting this condition by taking special care with insulation. Enameled wires, for instance, do not stand up in this climate and it has been found that reliability has been obtained by double silk covered or double cotton covered wire, hence, standardized goods of this type are of no value in this climate.

In Egypt, all nationalities may be found working as "Turners" and machinists. On the whole the work done by these men is good, although mass production as it is known in America does not exist there. The Egyptian can produce as much and as good work as the workman of the Western countries. Often he is satisfied to work harder and longer than the Western craftsman. Because of the lack of mass manufacturing methods and specialized work in the machine shops, the Egyptian machinist must be capable of adopting anything that comes into the shop. Again supervision is required as natives are apt to pass mistakes without saying anything to their employers. This habit may be summed up in the popular Egyptian expression "malish"—it doesn't matter, never mind.

Many of the machine shop workers of Egypt lack a thorough grounding in their work as there is no organized apprentice system as in America or Europe and their technical knowledge is confined largely to practical experience. These workers take pride in their craft and this is brought about by development of industrial schools for training men in manufacturing methods and practices. In Government shops, equipment is more modern than in the strictly commercial establishments and more accurate work is done in such shops. The working personnel is composed, largely, of Egyptians, Greeks, Maltese and Italians. The latter undoubtedly being the best due to superior opportunities

(Continued on page 26.)

TEAR OUT AND FILE FOR REFERENCE

SOLID OF REVOLUTION METHOD FOR CALCULATING DIE BLANKS

By O. B. JONES

Editor's Note: This is the concluding installment of the series on calculating die blanks. Judging from comments received, it has held much interest to members and readers of THE TOOL ENGINEER. *Preceding installments appeared in issues of January and February. A limited number of reprints of these are available free on request.*

THE volume of material in the 90° fillet of radius R in Fig. 24, if it is a 360° circular arc, can be found without knowing the location X of its center of gravity. We shall first determine its volume without using its center of gravity. We shall then determine the location of its center of gravity in order to indicate how it can be done and to simplify the solution of similar problems.

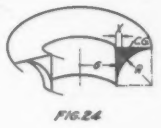


FIG. 24

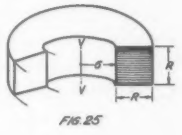


FIG. 25

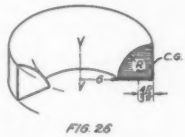


FIG. 26

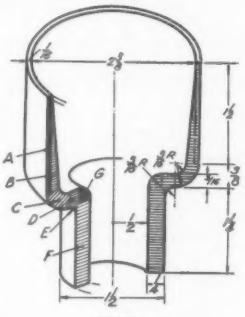


FIG. 27

If the square plane of area R^2 in Fig. 25 is revolved about the vertical axis VV located 6 units from, and parallel to, the altitude R, its radius of revolution is $6 + \frac{R}{2}$. Its mean circumference is $2\ Pi\ (6 + \frac{R}{2})$ and its volume $V = 2\ Pi\ (6 + \frac{R}{2})\ R^2 = 2\ Pi\ R^2\ (6 + \frac{R}{2})$ cubic units.

If the quadrant of radius R in Fig. 26 is revolved about the axis VV its radius of revolution is $6 + (R - \frac{4R}{3\ Pi})$. Its mean circumference is $2\ Pi\ [6 + (R - \frac{4R}{3\ Pi})] = 12\ Pi + 2\ Pi\ (R - \frac{4R}{3\ Pi})$. The area of the quadrant is $\frac{1}{4}\ R^2$. The volume of the solid is $V = [12\ Pi + 2\ Pi\ (R - \frac{4R}{3\ Pi})]\ (\frac{1}{4}\ Pi\ R^2)$ cubic units.

The volume of the fillet is the difference between the volume of the hollow cylinder in Fig. 25 and the volume of the solid in Fig 26, or its volume $V = 2\ Pi\ R^2\ (6 + \frac{R}{2}) - [12\ Pi + 2\ Pi\ (R - \frac{4R}{3\ Pi})\ (\frac{1}{4}\ Pi\ R^2)]$ cubic units.

To find the volume of the fillet in Fig. 24 by the solid of revolution method we start wth its means radius from VV to its center of gravity as $6 + X$. The mean circumfernce is $2\ Pi\ (6 + X)$. Its volume is its area times its mean circumference. Its area is $R^2 - \frac{Pi\ R^2}{4}$. Its volume $V = 2\ Pi\ (6 + X)\ (R^2 - \frac{Pi\ R^2}{4})$. Equating this volume to the volume previously found we have $2\ Pi\ (6 + X)\ (R^2 - \frac{Pi\ R^2}{4}) = 2\ Pi\ R^2\ (6 + \frac{R}{2}) - [12\ Pi + 2\ Pi\ (R - \frac{4R}{3\ Pi})\ (\frac{1}{4}\ Pi\ R^2)]$. Solving this equation for the location of the center of gravity, $X = .2233R$.

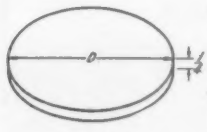


FIG. 28

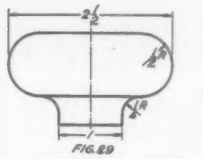


FIG. 29

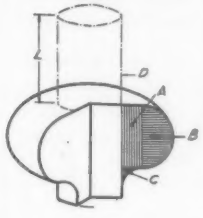


FIG. 30

If the sheet metal shell shown in Fig. 27 were to be produced in a punch press it would be necessary to determine the diameter D of the flat disc or blank in Fig. 28 from which it would be drawn. The blank must contain the same number of cubic units of metal as the completed shell in Fig. 27. The first step in determining the blank diameter is the determination of the number of cubic units of metal in the walls of the shell.

The cross section of the wall of the shell may be divided into seven areas as follows: A, rectangle, $1/16 \times 1\frac{1}{2}$; B, right triangle, $\frac{1}{8}$ base $\times$ $1\frac{1}{2}$ altitude; C, 90° sector between 3/16 and $\frac{3}{8}$ concentric arcs; D, square $3/16 \times 3/16$; E, 90°, $\frac{1}{8}$ R fillet; F, rectangle $\frac{1}{4} \times 1\frac{1}{4}$, and G, 90° sector of 3/16 R.

The volume of each of these seven sections is the product of its area and its mean circumference. The total volume of the shell is the sum of the seven volumes.

By the solid of revolution method the volumes of the seven sections are as follows:

Section *Area*

A $1/16 \times 1\frac{1}{2} = 3/32\ Pi\ (2\frac{3}{16} + 1/16) = 2\ 7/16\ Pi$
$3/32 \times 2\ 7/16\ Pi = .71790$

B $1/16 \times 1\frac{1}{2} = 3/32\ Pi\ (2\frac{3}{16} - 1/12) = 2\ 7/24\ Pi$
$3/32 \times 2\ 7/24\ Pi = .67495$

C $\frac{Pi}{16}\ (\frac{3}{4})^2 - (\frac{3}{8})^2 = \frac{27\ Pi}{1024}$ $Pi\ (1\ 3/4 + 2 \times .4244\ [(3/8)^3 - (3/16)^3] = 2.121\ Pi$ $\frac{27}{1024} \times 2.121\ Pi = .55205$
$(3/8^2 - (3/16)^2$

D $3/16 \times 3/16$ $9/256\ Pi\ (1\ 9/16)$ $9 \times 1\ 8/16\ Pi = \frac{225\ Pi}{4096} = .17256$
$1\ 9/16\ Pi$
$\overline{256}$

E $(1/8)^2 - 1/4(1/8)^2\ Pi = \frac{4 - Pi}{256}$ $Pi\ (1\ 1/2 + 2 \times .2232 \times 1/8) =$
$1.556\ Pi$ $\frac{3\ Pi \times 1.556\ Pi}{256} = .01636$

F $1/4 \times 1\frac{1}{4} = 5/16\ Pi\ (1 + 1/4) = 1\ 1/4\ Pi$ $5/16 \times 1\frac{1}{4}\ Pi = 1.122719$

G $\frac{Pi\ (3/16)^2}{4} = Pi\ (1\ 3/8 - 2 \times .4244 \times 3/16) = 1.21585\ Pi$

$\frac{Pi\ (3/16)^2 \times 1.21585\ Pi}{4} = .10547$

The total volume of metal in the walls of the shell is the sum of the seven volumes or 3.46648 cubic units.

If the shell were to be drawn from stock $\frac{1}{4}$ thick the blank must have an area of $3.46648 \div \frac{1}{4} = 13.86592$ square units. The diameter D of a circular disc containing this area is $D = 1.1284\ \sqrt{13.86592} = 4.202$.

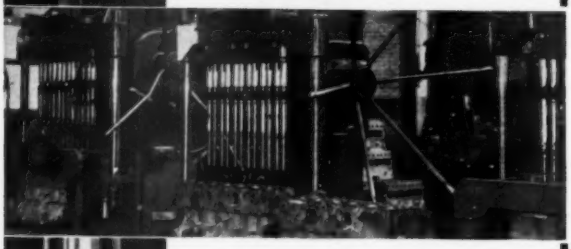
If the head shown in Fig. 29 is to be forged in a cylindrical bar of metal having a diameter of one unit, the length L of the bar,—shown in dotted outline in Fg. 30,—must be such that its volume when forced down to form the head is equal to the sum of the volumes of the solids of revolution whose areas are A.

To determine the volumes of the solids of revolution whose cross-sections are A, B, C and D we proceed as follows:

(Continued on page 26.)

TEAR OUT AND FILE FOR REFERENCE

MIDWEST
.001" Adjustment Extension Holders



COMPENSATE for unequal tool wear, different tool lengths, and various depths of work on multiple tool set-ups.

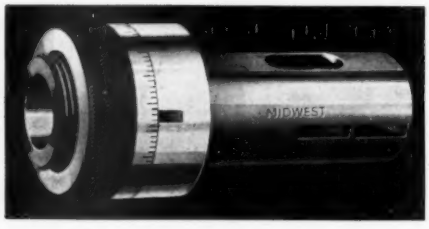
Longitudinal adjustments from .001" to 1½" quickly made by hand. No wrenches required. No screws or locknuts to cause trouble. Positively self-locking.

Accurate alignment assured by straight ground fit between sleeve and shank. Positive drive provided by key anchored in sleeve and having slidable fit in keyway in shank.

Can be furnished with float between extension and tool.

Described and listed on pages 31 to 35 of No. 14-M Midwest Catalog. Send for a copy today.

Midwest Adjustable Nose Pieces



Can be incorporated directly in spindle noses of multiple spindle machines and drill heads. Fundamental details for MACHINE TOOL BUILDERS page 34 Catalog No. 14-M. Send for a copy.

Midwest Tool & Mfg. Co.

2360 W. Jefferson Ave. Detroit, Mich.

NEW LITERATURE

Brown & Sharpe Mfg. Co. New Catalog No. 140: A new general catalog of nearly 700 pages, latest edition, complete catalog of Brown & Sharpe Machinery and Tools. Pocket size 4½ x 7 inches. Address Brown & Sharpe, Providence, Rhode Island for copies.

Pratt and Whitney Circular No. 420: This circular describes gear grinding with complete information on Pratt & Whitney 10" Hydraulic Gear Grinder for Spur and Helical Gears, the Two Wheel 10-in. Hydraulic Gear Grinder for Spur and Helical Gears with specifications as to capacity, speeds, floor space, weight, etc.

Pratt and Whitney also announce issuance of their **Circular S-454** which shows Keller Expanding Rubber Polishing Wheels and Sanding Drums and Abrasive Belts and Sleeves. For copies of these two circulars address Pratt & Whitney Company, Hartford, Connecticut.

Michigan Tool Company Bulletin "A New Basis for Reducing Gear Finishing Costs": The bulletin describes gear production by the new Michigan Tool Company Gear Finishing Machine. "Automatic Accuracy" is claimed for the new machine and that the basic principle of the Michigan Gear Machine Finishing Process is that differences in spiral angle or diameter mean only that the angular relation of the gear axis to the rack has been changed, and that the rack is the starting point for the design of any gear. Address inquiries to Michigan Tool Company, Detroit, Michigan.

Catalog No. 2 has just been issued by **Putnam Tool Company** of Detroit, Michigan. Precision tools, including a wide range of single and double end mills, jig borers and end mill holders are described.

McCrosky Tool Corporation, Meadville, Pennsylvania Bulletin No. 15-B. Fully describes McCrosky Block-Type Adjustable Boring Bars—sizes, prices, instructions, detail drawings etc. Address the company at Meadville for copies.

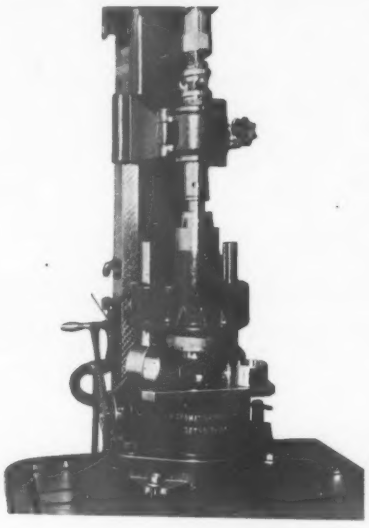
Sutton Tool Company, 2842 W. Grand Boulevard, Detroit, Michigan Catalog No. 12. Collets, Feed Fingers and other Automatic and Hand Screw Machine Accessories. Unusually attractive and profusely illustrated. Detailed descriptions and photographs as well as drawings on everything in this line. Write for a copy.

Federal Products Corporation new catalog. Describes standard line of Federal indicators and includes new instruments recently brought out, also special matter devoted to practical application of dial indicators such as a stress gauge for determining the compressibility of semi-hard materials, a gauge for checking spools for thread manufacturers, another for checking the serrations of thread dies, etc. Address the company at Providence, R. I. for copies.

In a Spirit of Mutual Helpfulness—we ask that all members and readers of *The Tool Engineer* mention it to advertisers when making inquiries. You help yourself by helping to continue the publication of your paper when advertisers know that you read it and notice their advertisements.

Q-C ENGINEERING

As Usual Leads the Way.



Closer tolerances and better finishes are today secured on many parts through Honing.

To secure the extreme accuracy required conventional methods of work holding and locating will not suffice. Through extended experimentation and cooperation with the Micromatic Hone Corporation of Detroit we have developed Honing fixtures incorporating the elements necessary to complete satisfaction.

Pictured herewith, Barnes Honing Machine, Micromatic Hone, Work Holding Fixture. Operation automatic Honing I.D. of Roller Bearing Race in one operation to limits of .0002 roundness and total taper. Micro-honed Mirror Finish. Production 150 pieces per hour.

Let us assist *you* with your Honing problems.

Q-C ENGINEERING PRODUCTS

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WE ASK YOU ---

Does your reamer grinding life cost as little as

2c per .001"

It would if you were using

GG & GG

SERRATED BLADE CAM LOCK REAMERS

Divide the cost of a set of the reamer blades you are using by the number of thousandths of an inch of grinding life they will provide and decide on their economy for yourself.

Serrated blade cam lock reamers provide as much as 5/8" grinding life on the diameter of the 4 1/2" size. Other sizes proportional.

GODDARD & GODDARD CO.

DETROIT

(Continued from page 23.)

Section	Area	Mean Circumference	Volume
A	$\frac{1}{4}\times 1 = \frac{1}{4}$ Pi	$\times 1\frac{1}{4} = \frac{5 \text{ Pi}}{4}$	$\frac{1}{4}\times 5 \text{ Pi} = \frac{5 \text{ Pi}}{4} = \frac{5 \text{ Pi}}{16}$ = .98175
B	$\frac{1}{2}\times(\frac{1}{2})^2$ Pi = $\frac{1}{8}$ Pi	Pi$(1\frac{1}{2}\div 2\times .4244\times\frac{1}{2})$ = 1.9244 Pi	$\frac{1}{8}\times 1.9244$ Pi = 2.37414
C	$(\frac{1}{4})^2-\frac{1}{4}\times(\frac{1}{4})^2$ — .01342 Pi	$(1\div 2\times .2333\times\frac{1}{4})$ = 1.1117 Pi	.01342 × 1.1117 Pi = .04684
D	$\frac{1}{2}\times$L $1\frac{1}{2}$L	Pi$\times\frac{1}{2}$ 1.5 Pi	$\frac{1}{2}$L$\times\frac{1}{2}$Pi = $\frac{1}{4}$ Pi L

The total volume of the three sections A, B and C is 3.40276 cubic units. This total volume must equal the volume of D, or 3.40276=¼ Pi L. Solving this equation for the length, L= 4.332.

DETROIT MACHINE DEALERS ELECT OFFICERS

Machinery Dealers of the Detroit area held their annual meeting, recently, at the Recess Club. The following officers were elected to serve for one year: President, John Sauer — Peninsular Machinery Company, Vice President, Homer Baylis — Motch and Merryweather, Secretary and Treasurer, George Turner—Strong Carlisle & Hammond Company.

Retiring President English of English & Miller, conducted the meeting and installed the new officers.

A piece of hardened tool steel in the shape of a horseshoe can be magnetized to lift approximately 10 pounds per square inch.

The hardest tumble a man can take is to fall over his own bluff.

SHOP PRACTISES

(Continued from page 22).

for training at home. As an interesting sidelight, these different nationalities pull well together and the language problem is solved by the fact that each acquires a smattering of the other's language.

All in all, the Oriental has caught the spirit of progress, and is fast learning to keep step with the Occidental parade.

CARBOLOY ANNOUNCES NEW WHEEL DRESSER

Carboloy Company, Incorporated, Detroit, announces an additional grade of their diamond impregnated wheel dresser. The new grade contains an extra coarse mesh of diamonds and has been developed to increase the order of performance on the larger and harder grades of grinding wheels used on surface, cylindrical and centerless grinders.

RAPID SLIP DRILL CHUCKS and COLLETS

for drill presses, lathes, screw machines.

increases efficiency many times — will not injure collet under hardest service.

Ask for Bulletin No. 11.

American Equipment Co.

5928 Second Blvd., Detroit, Mich.

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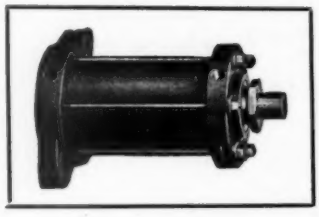


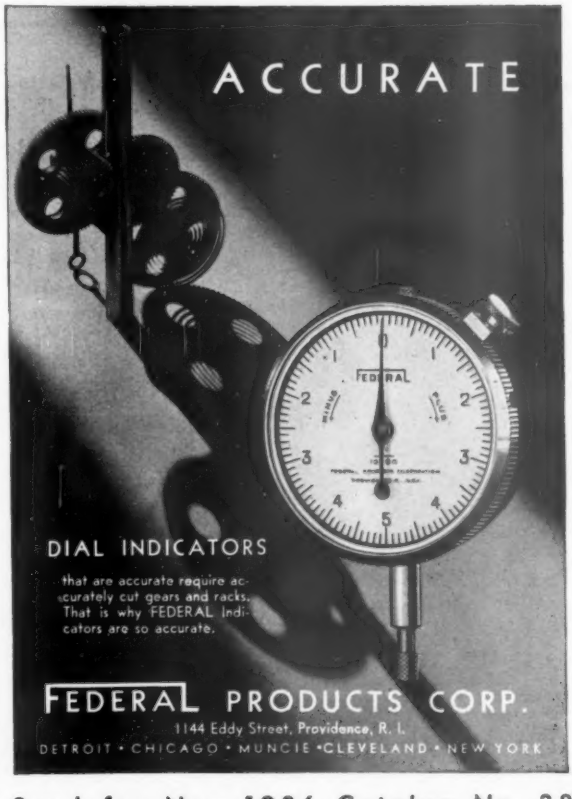
STYLE 4 NON-ROTATING DOUBLE-ACTING AIR CYLINDERS

Made also in six other standard styles or special to suit your installation, cushioned on both ends or either end, if desired.

THE TOMKINS-JOHNSON CO.

624 N. Mechanic St., Jackson, Mich.

Detroit Representative HABERKORN & WOOD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that are accurate require accurately cut gears and racks. That is why FEDERAL Indicators are so accurate.
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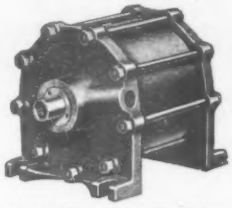
Send for New 1936 Catalog No. 38



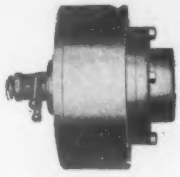
MODEL "B" AIR CYL.

"LOGAN"

AIR OR HYDRAULIC

CYLINDERS

WILL SOLVE YOUR PRODUCTION PROBLEMS



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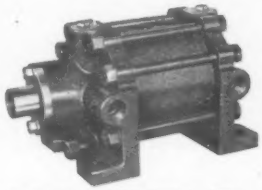
MANUFACTURED IN SEVEN MODELS, FOR AIR, OIL OR WATER SERVICE.



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AIR CATALOG-S-25 HYD. CATALOG AH-31

MODEL "HR" HYD. CYL.

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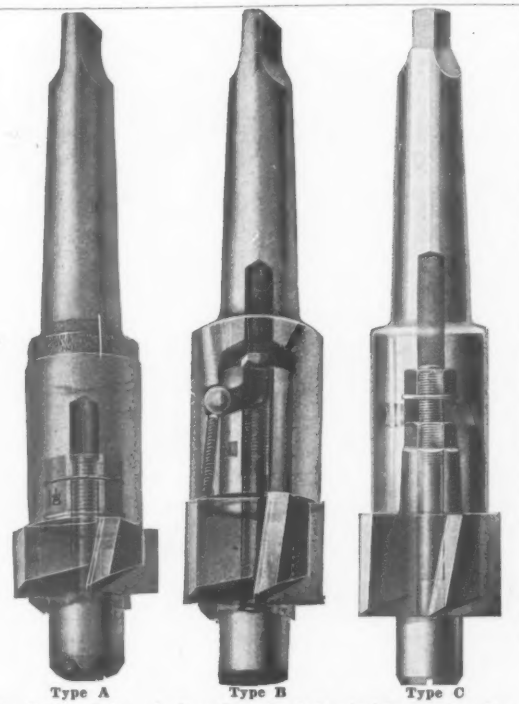
LOGANSPORT - - - - INDIANA



Type A Type B Type C

The design of these tools and mechanical principles are based on practical experience and knowledge of the varied conditions under which counterboring is done. We can meet all your regular and special needs for counterboring and spotfacing tools.

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THE GAIRING TOOL CO., Detroit

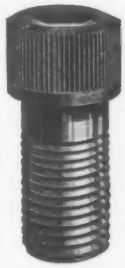
COUNTERBORES SPOTFACES CORE DRILLS

"UNBRAKO"

UNBRAKO HOLLOW SET

AFTER a great many years on the market the "UNBRAKO" is still among the top-notchers, or in other words: None is better.

FREE SAMPLES OF BOTH SET & CAP



KNURLED UNBRAKO

All mechanics use their fingers driving Screws.

Knurls gear fingers to head; fingers, therefore, have better purchase, drive faster and further.

Pliers bite the Knurled "Unbrako," but slip on Smooth-Heads.

Remember: The Knurled "Unbrako" is the only Socket Head Cap Screw that can be locked when countersunk.

The Knurled "Unbrako" looks trim and attractive and dolls up any piece of machinery.

U. S. & Foreign Pats. Pending

ORDER BY NAME—SPECIFY THE KNURLED "UNBRAKO"

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Easy to pick out small tools and stock

AMES DIAL "MIKE" POCKET GAUGE

$15.00

Measures ½-1000" and even less—accurately, easier and quicker than old style micrometer.

1. One inch capacity
2. Finger grip for easy handling
3. Lock for use as snap gauge
4. Can be carried in pocket
5. Made of rustless metal

Write Department M

Fractional equivalents on back

B. C. AMES COMPANY
WALTHAM, MASS.

DE-STA-CO Toggle Clamps

DE-STA-CO Toggle Clamps shown at left are used as index gauge to locate work, and clamp at right holds steel bar in position during drill machine operations. These clamps are a dependable device that hold production articles, such as metal parts, stampings, castings, forgings and similar pieces in a jig or fixture during subsequent operations.

Made in three standard sizes each with choice of several standard base styles. Send for literature.

DETROIT STAMPING CO.
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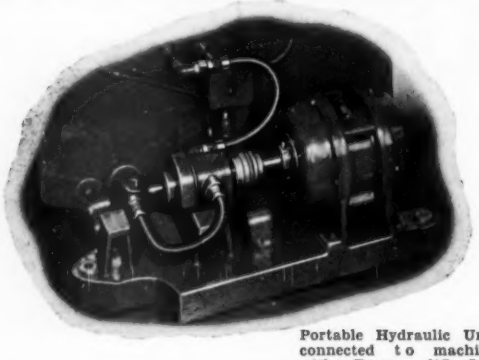

Portable Hydraulic Unit connected to machine with Fauver ½" I.D. Pressure Proof Hose under 3,000 lbs. pressure.

Tough going!

Wherever hydraulic power must be transmitted (pressures up to 15,000 lbs.)—wherever coolants, lubricants, cutting oils, plastics must be served to moving parts—there the service calls for flexible hose that can take it. On such tough going, Fauver "Oil Resist and Pressure Proof" Hose Assemblies live long, keep machines functioning.

Ask for descriptive circular.

J. N. FAUVER CO., INC.

Complete stock of Hose, Norgren Valves and Fittings, Parker Threadless Tube Couplings.

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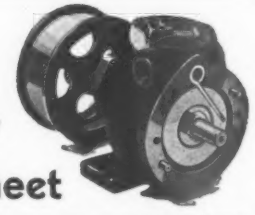
Send for this New Pump Data Sheet



It contains the definite data engineers want when they're selecting coolant and lubricant pumps. It describes ROLLWAY PUMPS as engineers want them described—no sales talk—no ballyhoo. Ask for a copy for your files.

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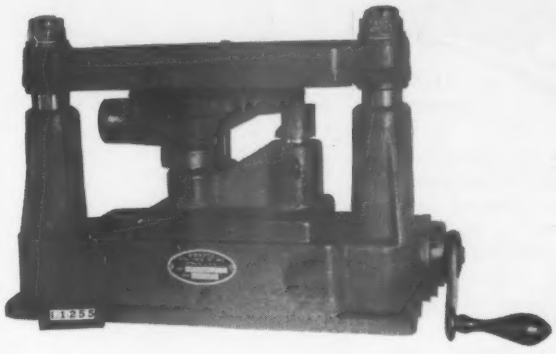

Part—Water pump body.

Operation—Drill bolt holes.

Features—This adaptation of a standard LL-77 Swartz fixture shows the simplicity and speed with which a rough casting is located and clamped. Two lower adaptors are used. One is a cone to locate large boss and the other is a "V" to locate small end of casting. These two adaptors compensate to allow part to square itself against top face.

SWARTZ TOOL PRODUCTS CO., INC.

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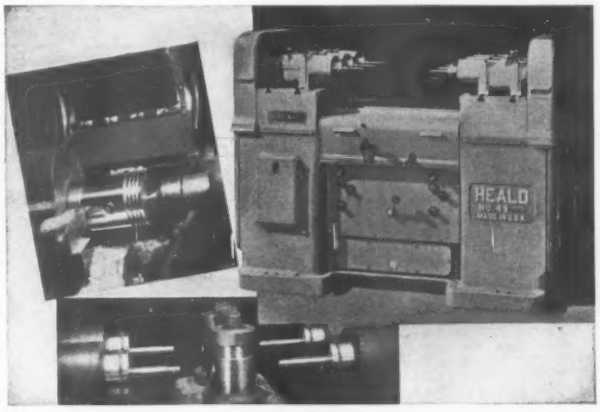

FOR PISTONS—At the top, a double end No. 49 Bore-Matic is turning on aluminum piston with head end round and .025″ smaller in diameter than the skirt which was tapered .0015″ and eliptical .010″. Below, the same machine is roughing wrist pin holes on one side and finish boring on the other. The alignment is perfect.

Precision Boring and Grinding

The Style No. 49 Double End Bore-Matic, shown opposite, is but one of the many different styles and sizes found in the Heald complete line of Precision Boring and Grinding Machines.

Our engineers are fully familiar with both precision boring and precision grinding. Therefore, regardless of what you have to be precision finished, we are in a position to furnish unbiased recommendations that will meet your requirements to best advantage. Glad to offer suggestions. No obligation.

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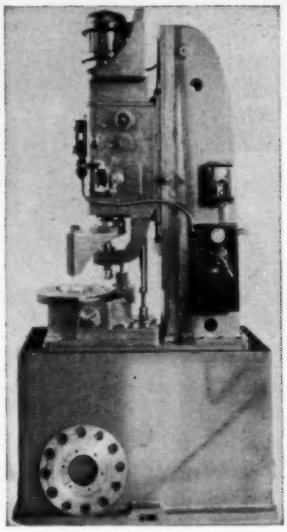

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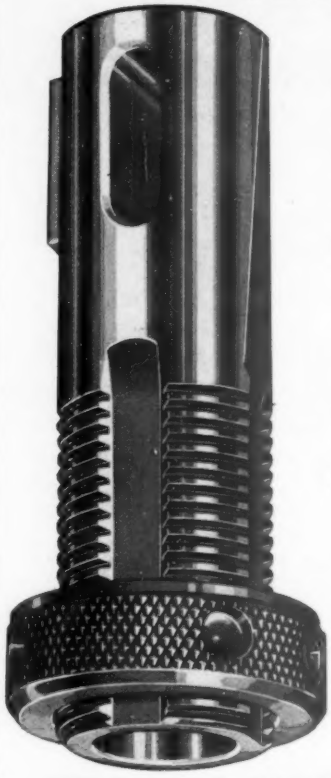
FOR MULTIPLE SPINDLES



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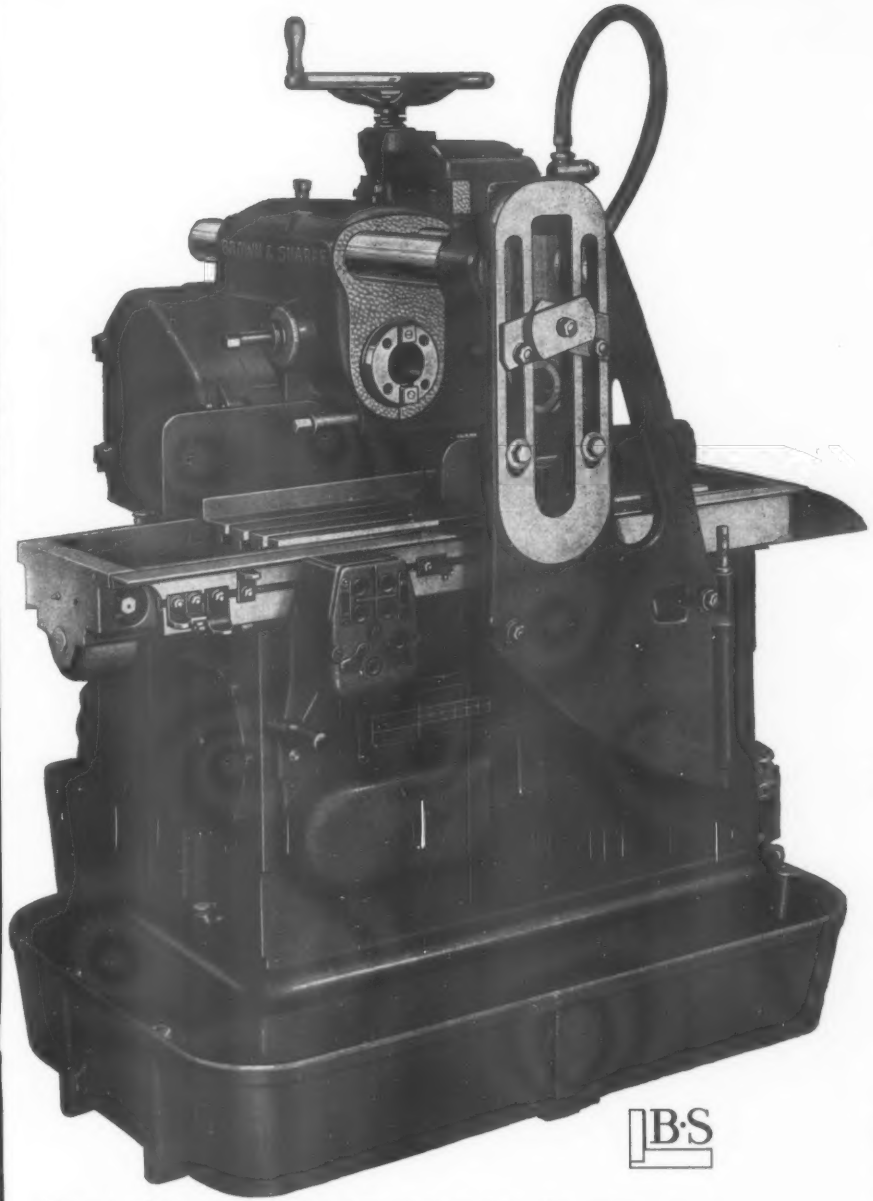

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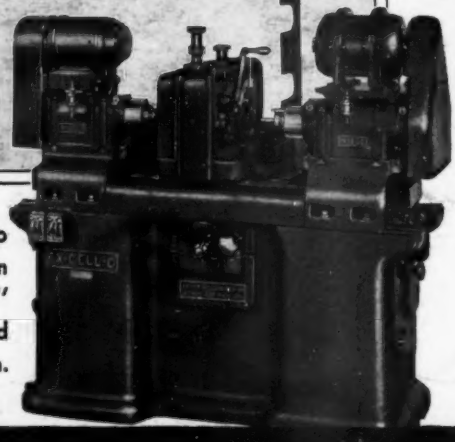

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